

WHAT IS CLAIMED IS

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1. Apparatus for applying compressions to the chest of a patient to at least stimulate blood circulation, which includes an energizable actuator that repeatedly presses against the patient's chest area, a torso wrap that is coupled to said actuator and that wraps to the back of the patient, and a stabilizer that lies around said actuator to minimize tilt of the actuator with respect to the patient's chest, wherein:

said stabilizer extends substantially completely around said actuator without a continuous gap of more than 90°, and said stabilizer has a central hole through which said actuator extends.

2. The apparatus described in claim 1 wherein:  
said stabilizer is formed of an inflatable flexible casing.

3. The apparatus described in claim 1 wherein:  
said stabilizer is formed of foam.

4. The apparatus described in claim 1, including:  
a container of pressurized breathable gas having a higher concentration of oxygen than is found in the atmosphere, said container connected to said actuator to energize it, and means for supplying said gas from said container to the patient.

5. The apparatus described in claim 1 including a container of pressurized gas of a pressure of over 100 psi, and said actuator is energizable by said pressured gas, and including:

a conduit that carries gas exhausted from said actuator to the respiratory

system of the patient.

6. The apparatus described in claim 1 wherein:

said actuator includes a stationary frame and a reciprocating member that lies within said frame and that moves up and down with respect to said frame, said frame being fixed to said stabilizer so said frame cannot move up and down with respect to said stabilizer.

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7. The apparatus described in claim 1 wherein:

said actuator comprises a cylinder and a piston that presses against the patient's chest, and including means for urging said piston upwardly after each time said piston presses against the patient's chest other than by the patient's chest.

8. The apparatus described in claim 1 wherein:

said actuator includes a reciprocating member that is repeatedly driven downward, and a pressing member that lies at a lower end of said reciprocating member and that presses against the patient's chest, said pressing member being pivotally connected to said reciprocating member to allow said pressing member to tilt about horizontal axes relative to said reciprocating member.

9. The apparatus described in claim 1 including:

a control that controls said actuator in repeated cycles of no more than about one second per cycle, with said actuator energized to press against the patient's chest for no more than 30% of the period of each cycle and to not press against the patient's chest during at least 70% of each cycle.

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10. Apparatus for applying compressions to the chest of a patient to at least stimulate blood circulation, which includes an energizable actuator that repeatedly presses against the patient's chest area, and a torso wrap that is coupled to said actuator and that wraps to the back of the patient, wherein:

5        said actuator includes a stationary frame, a reciprocation member, and means for cycling said reciprocating member relative to said frame to press said reciprocating member down toward the patient's chest, and to automatically apply an upward force to said reciprocating member relative to said frame to help raise the chest without shaping the chest, to thereby obtain a more rapid cycle or a  
10        greater vertical movement of the chest in each cycle of chest compression.

11. The apparatus described in claim 10 wherein:

      said means for cycling includes a spring that applies said upward force to said reciprocating member.

12. The apparatus described in claim 10 wherein:

      said reciprocating member includes a cylinder forming said stationary frame and at least two piston parts that telescope one into the other with one of said piston parts being slideable in said cylinder, to thereby minimize the height that the  
5        actuator extends above the patient's chest.

13. The apparatus described in claim 12 including a source of pressurized gas connected to said cylinder, and wherein:

      a smallest diameter one of said piston parts has an inside diameter at least half the inside diameter of the largest diameter one of said piston parts.

14. The apparatus described in claim 10 including:

means for sensing recovery of the patient's chest, for controlling the instant in each cycle at which said means for cycling begins to again move said reciprocating member to depress the patient's chest.

15. The apparatus described in claim 10, wherein said frame is a cylinder and said reciprocating member is a piston that slides in said cylinder, and including:

a pressing member lying below and pivotally connected to a lower end of said piston to enable pivoting about horizontal axes, said pressing member having a lower surface for pressing against the patient's chest.

16. The apparatus described in claim 10 wherein:  
said reciprocating member is free of attachment to the patient's chest.

17. The apparatus described in claim 10 including:  
a stabilizer extending completely around said actuator.

18. Apparatus for applying compressions to the chest of a patient to at least stimulate blood circulation, which includes an energizable actuator that repeatedly presses against the patient's chest area, and a torso wrap that is coupled to said actuator and that wraps to the back of the patient, the actuator including a stationary cylinder and a piston that is cyclically driven downward down toward the patient's chest, and cyclically allowed to move upward while the chest of the patient moves upward, wherein:

said actuator includes a pressing member lying below said piston;

a pivot joint that connects said pressing member to said piston, and that allows said pressing member to pivot about two perpendicular horizontal axes

relative to said piston.

19. The apparatus described in claim 18 wherein:

said pivot joint includes a ball element and a socket element that receives the ball element, one element mounted on said reciprocating member and one mounted on said pressing member.

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20. The apparatus described in claim 18 wherein:

said cylinder has an exhaust outlet;

said source of pressurized gas stores breathable gas; and including

means coupled to the exhaust outlet and to the patient, for delivering

exhaust gas to the patient.

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21. The apparatus described in claim 18 including:

a stabilizer that extends completely around said actuator, to minimize tilt of the actuator with respect to the patient.

22. The apparatus described in claim 18, including:

means for urging said reciprocating member upward after each time that said reciprocating member is driven downward, other than by upward applied by the patient's chest.

23. Apparatus for applying compressions to the chest of a patient to at least stimulate blood circulation, which includes an energizable actuator for repeatedly pressing against the patient's chest area, comprising:

a source of breathable pressurized gas and an actuator coupling for coupling said source to said actuator for energizing the actuator;

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said actuator has an exhaust port, and including a patient coupling for coupling the exhaust port to the patient's respiratory system so the patient can breathe gas from the actuator.

24. The apparatus described in claim 23, including:

a stabilizer that completely surrounds said actuator and that presses against the patient's chest.

25. A method for applying pressure pulses to a patient's chest to stimulate blood circulation and breathing, by repeatedly applying downward forces to a reciprocating member, relative to a frame, while the reciprocating member lies adjacent to a patient's chest, comprising:

5 automatically applying upward forces to said pressing member in between said steps of repeatedly applying downward forces to said actuator member, without shaping the patient's chest, whereby to enable better control of chest recovery after each chest compression.

26. The method described in claim 25 wherein:

said method includes applying pressure pulses in cycles that repeat;

said step of applying force comprises applying downward force during no more than about 30% of the period of each cycle, and allowing the patient's chest to move upward during at least about 70% of each cycle.

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27. The method described in claim 25 including:

adhering said reciprocating member to the patient's chest, and pulling upward on the patient's chest at least part of the time of each of said steps of applying upward forces to the member.

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28. A method for applying pressure pulses to a patient's chest to stimulate blood circulation and breathing, by energizing an actuator that repeatedly applies downward forces to a reciprocating member relative to a frame to cause the member to depress the patient's chest, while also applying oxygen-rich gas to the patient, comprising:

supplying pressurized breathable gas to the actuator and exhausting lower pressure gas from the actuator;

supplying said lower pressure gas from the actuator to the patient for breathing by the patient.

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29. A method for applying pressure pulses to a patient's chest to stimulate blood circulation and breathing, by repeatedly automatically energizing an actuator to apply downward forces to cyclically depress the patient's chest and to cyclically not depress the chest to allow the chest to recover by moving up, comprising;

controlling said actuator to apply downward forces during no more than 30% of each cycle, and allowing chest recovery during at least 70% of each cycle.

30. The method described in claim 29 wherein:

said step of energizing an actuator includes flowing compressed breathable gas to the actuator, and including flowing some of the gas that has passed into the actuator, to the patient for breathing by the patient.

31. The method described in claim 29 wherein:

said actuator includes a portion that moves down to depress the patient's chest, and including:

biasing said actuator portion upwardly in each cycle, between said steps of energizing the actuator to depress the chest, to reduce or eliminate any load on the chest that the patient's chest must raise.

32. The method described in claim 29 including:

allowing a lower end of said actuator that has a flat surface that presses against the patient's chest to tilt a plurality of degrees about two perpendicular horizontal axes with respect to the rest of said actuator.